



U.S. Department
of Transportation
**Federal Aviation
Administration**

Advisory Circular

Subject: QUALIFICATION OF FUELS,
LUBRICANTS AND ADDITIVES
FOR AIRCRAFT ENGINES

Date: 12/20/85
Initiated by: ANF-110

AC No: 20-24B
Change:

1. PURPOSE. This advisory circular (AC) describes procedures which may be used for approving the qualification of fuels, lubricants and additives for use in certificated aircraft engines.
2. CANCELLATION. AC No. 20-24A, effective April 14, 1967, is cancelled.
3. BACKGROUND. In certificating an engine, the Administrator has responsibility under Federal Aviation Regulations (FARs), Part 33, for establishing the limitations for the engine operation on the basis of the operating conditions demonstrated during the block tests. Such operating limitations include those items relating to power, speeds, temperatures, pressures, fuels, and lubricants which are found to be necessary for safe operation of the engine. The limitations on fuels and lubricants include the additives that may be blended with the fuels or lubricants. The suitability and durability of all materials used in the engine are established on the basis of experience or tests, and all materials used in the engine must conform to approved specifications. Experience and test data should be on engine models which are, at minimum, similar in configuration, materials, operating characteristics, and power category to those of the engine in which these materials are intended for use.
4. DISCUSSION. Fuels and lubricants found to perform satisfactorily during the type certification program of an engine are approved as part of the Type Certificate (TC) and are listed on the pertinent Type Certificate Data Sheet (TCDS). Issuance of the TC constitutes approval of the fuel and lubricant specifications provided by the engine manufacturers. It is Federal Aviation Administration (FAA) policy that fuels and lubricants produced by companies other than those used in the type certification program may be used in a certificated engine provided the products meet the fuel(s) or lubricant(s) specification(s) for that engine. Fuels or lubricants that are not in conformance with the TC holder's approved specification listed on the TCDS, or a specification approved under a Supplemental Type Certificate (STC) are not eligible for use in a certificated engine. These non-conforming fuels or lubricants must satisfy the certification requirements outlined in Paragraph 5 of this AC, PROCEDURE, in order to be approved. In addition, all synthetic lubricants are considered "new material" and must be individually approved. Additives to be used as a supplement to an approved fuel or lubricant also are considered to be a "new material" because their addition can significantly alter the physical and chemical properties of the fuel or lubricant. These additives must be

approved on an individual basis. In all cases, separate approval is required for each engine model or model series. In order to extend an approval from one model series on to another entire class of engines (i.e., all Lycoming non-supercharged direct drive engines up to 720 cubic inch displacement), it must be substantiated that the engine tested represents the most severe operating conditions of all the engines for which approval is requested. For reciprocating engines, factors which should be considered include piston speeds, maximum BMEP, maximum cylinder and barrel temperature limits, turbocharger lubrication design, piston ring configurations, and gaskets, rings, and seals used in the engine and propeller oil system. Further, such materials are not eligible to be used in a certificated aircraft until the compatibility of these materials has been established with aircraft components (including propellers, where applicable) with which they come in contact.

5. PROCEDURE. The producer of a product requiring an STC or an amendment to an existing TC, as described in Paragraph 4 above, may apply to the Aircraft Certification Office (ACO) in the geographical area in which the applicant is located. The geographic ACO will administer the program; however, the ultimate approval and issuance of the engine STC, or an amendment to an existing TC, is the responsibility of the Engine and Propeller Certification Directorate located in the New England Region. Such STCs or amended TCs, may be approved for the fuels, lubricants, and additives for use in designated engine(s) upon receipt of suitable data demonstrating compliance with the applicable portions of FAR Part 33. The data should be obtained during an FAA approved and witnessed test program and should include the following:

a. Preliminary Data - Prior to FAA authorization for test, the applicant should submit a report to substantiate that the fuels, lubricants, or additive combinations have undergone sufficient test and development to show that, under the conditions in which they will be used in the aircraft, they are compatible with the applicable engine and aircraft materials. The data should include compatibility with fuels, lubricants, and additives that are approved for the engine, propellers (where applicable), and aircraft. For fuel additives, the additive must be soluble in the fuel at all anticipated temperatures; the blending procedures must be feasible; the additive must be shown not to congeal at cold temperatures, thereby clogging fuel lines and filters; the additive must be compatible with other approved fuel additives (i.e., anti-icing additives); and the additive should not change fuel octane number.

b. Test - A description of the test program and equipment that the applicant proposes to use in demonstrating the airworthiness of the material to be approved shall be submitted for approval. The engine(s) which are selected must be subjected to the pretest inspection, FAR 33.42 and 33.82; the calibration tests, FAR 33.45 and 33.85; the endurance test,

FAR 33.49 and 33.87; the operation test, FAR 33.51 and 33.89 and the teardown inspection, FAR 33.55 and 33.93. It is conceivable that the requirements of the operation test, FAR 33.51 and 33.89, can be satisfied concurrently with or as an addendum to the endurance test, FAR 33.49 and 33.87. The applicant is requested to submit for FAA approval, the specific engine test procedure for each of the engines which will be subjected to the 150-hour endurance test. This test procedure should provide all the specific information required to perform the test (i.e., test location, engine model to be tested, specific test hardware and instrumentation to be used, engine minimum and maximum operating parameters, the engine lubricant to be used, the lubricant change interval, a list of all information to be recorded during the test including changes to oil properties, the intervals at which this data is to be recorded, etc.) In addition, in accordance with FAR 33.53 and 33.91, engine component test, a test should be performed with the objective of showing that the subject material will not cause deterioration or any other unsatisfactory condition on or in any of the non-metallic engine oil-wetted parts used in any of the engines in which the additive is used. A 500-hour controlled flight test, under the test conditions listed below, may be considered as an equivalent for the endurance portion of the requirements of FAR 33.49 and 33.87, when followed by a complete teardown inspection:

Takeoff power or thrust	5 hours minimum
Max. continuous power or thrust	20 hours minimum
Cruise power or thrust	450 hours minimum
Idle	25 hours minimum

c. Final Data - At the completion of the aircraft engine tests, a report should be submitted which includes, at minimum, the following:

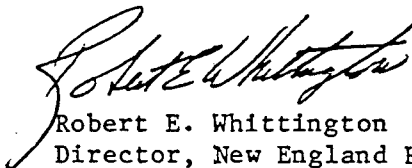
- (1) A description of the engine in which the material was tested.
- (2) A chronological history of test conditions and engine performance, including r.p.m., power or thrust levels achieved during the test, fuel and oil consumption, oil changes, parts replacement, and other pertinent test results.
- (3) An analysis of lubricating oil samples taken before and after the test, and before each oil change. These analyzes are required for both fuel and oil substantiation testing.
- (4) An analysis of the fuel used during the test. For fuel substantiation testing, these analyzes must demonstrate minimum or "worst case" properties.

(5) Evidence that abnormal wear, deposits metal attack, or other harmful effects did not occur as a result of the material under test.

(6) Evidence to establish that deterioration, excessive seal swelling, shrinkage, hardness, or unsatisfactory condition on or in any of the non-metallic engine oil-wetted parts did not occur as the result of the material under test.

d. Identification - The material tested must be covered by a specification that is written in sufficient detail to provide, at minimum, the physical properties and limits by which uniform quality and composition can be maintained. If the material is to be used in a blend with another material, instructions for blending should be provided which include safety precautions.

e. Concentration - The materials tested should be approved for use only in the concentrations "up to the maximum" at which they were qualified by test.



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